

SPATIAL COGNITION

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SPATIAL COGNITION is the ability to reason about geometric relationships in the real (or a metaphorical) world based on one or more internal representations of those relationships. The study of spatial cognition is concerned with the representation of spatial knowledge, and our ability to manipulate these representations to solve spatial problems. Spatial cognition is utilized most critically when direct perceptual cues are absent or impoverished.

Our presentation provides examples of how human spatial cognitive abilities impacts on three areas of space station operator performance: orientation, path planning, and data base management. A videotape provides demonstrations of relevant phenomena (e.g. the importance of orientation on recognition of complex, configural forms). The following readings are suggested as entries into the psychological literature on spatial cognition:

- Olson, D. R. & Bialystok, E. (1983). Spatial Cognition. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.
- Rock, I. (1984). Perception. New York: Scientific American Books, Inc.
- Shepard, R. N. & Cooper, L. A. (1982). Mental Images and their Transformations. Cambridge, MA: The MIT Press.

AREAS IN WHICH SPATIAL COGNITION IMPACTS PERFORMANCE:

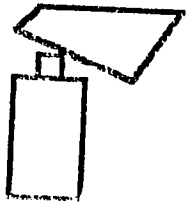
- * ORIENTATION
- * PATH PLANNING
- * DATA BASE MANAGEMENT

SPECIAL CONCERNS OF SPACE STATION

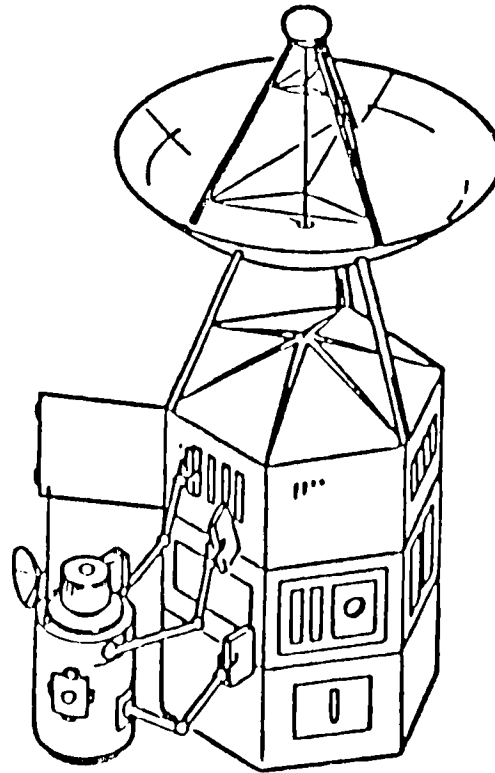
- * ABSENCE OF VESTIBULAR CUES
- * MULTIPLE FRAMES OF REFERENCE
- * ADDITIONAL DEGREES OF FREEDOM
- * COMPLEX, NON-INTUITIVE DYNAMICS

ORIENTATION ONBOARD THE SPACE STATION: A CHALLENGE TO SPATIAL COGNITION

80



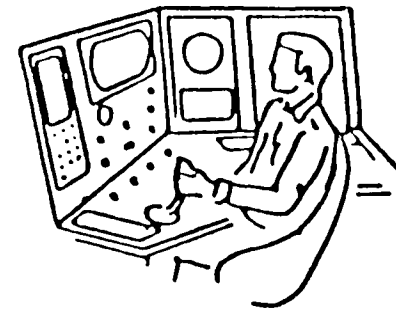
FREE FLYER VERTICAL



TELEOPERATOR VERTICAL

SATELLITE VERTICAL

MULTIPLE CAMERA ANGLES
(POINTS-OF-VIEW)

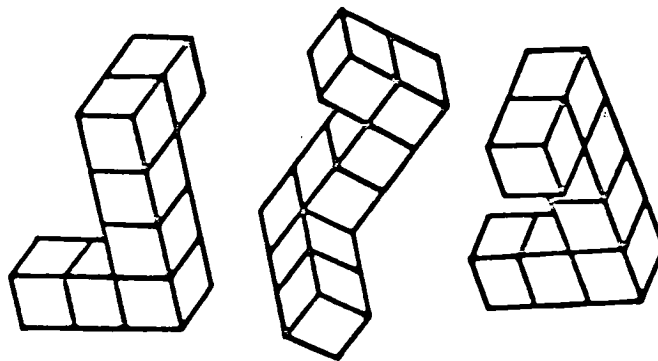


STATION LOCAL VERTICAL

EARTH-DOWN VERTICAL

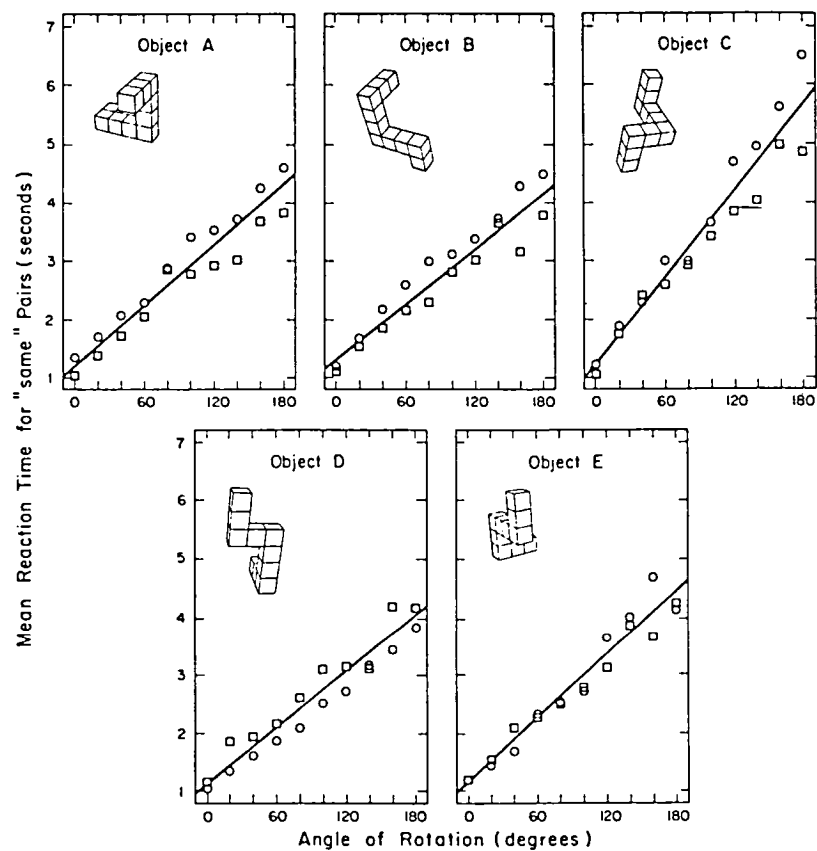
SPATIAL TRANSFORMATIONS INVOLVE TIME-DEPENDENT MENTAL OPERATIONS

MENTAL ROTATION

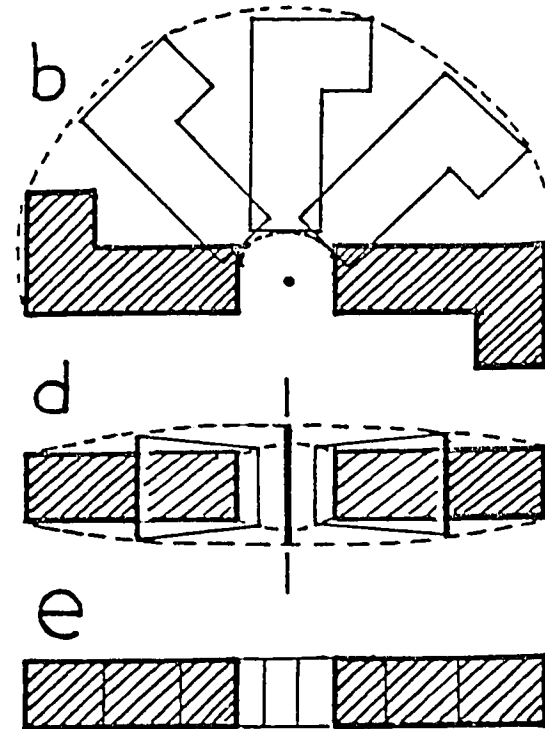
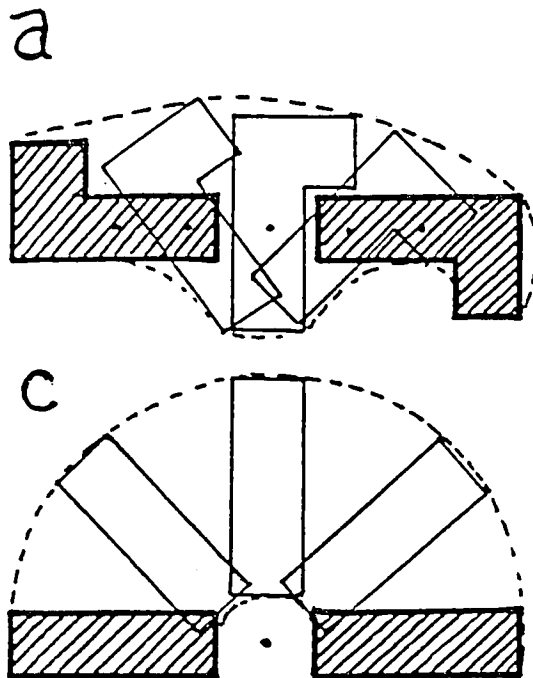


PAIR A
"SAME"

PAIR B
"DIFFERENT"



OBSERVERS IMPOSE KINEMATIC AND KINETIC CONSTRAINTS ON AMBIGUOUS VISUAL DISPLAYS



THREE POSSIBLE STRUCTURES FOR A DATA "ENVIRONMENT"

